United States Department of Agriculture
Bureau of Biological Survey

Wildlife Research and Management Leaflet BS-84

Washington, D. C. * March 1937

FOOD OF THE SCALED QUAIL

(Preliminary Report)

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Contents

INTRODUCTION

The scaled quail (Callipepla squamata), also called blue quail, cotton top, and white topknot, is one of the most interesting game birds of the Southwestern States. Although in some quarters its value as a sporting bird has been questioned, because it does not lie well to dogs and avoids intruders by running rather than by flying, its local abundance and wide distribution, as well as its use as a table delicacy, make it desirable to give full consideration to its food requirements. Even greater possibilities for the bird may be found when its life history and amenability to game management have been thoroughly worked out.

The scaled quail may be recognized in the field by the following characters: In size and shape it is similar to the bobwhite quail, being 9 1/2 to 12 inches long; it is mostly bluish or slaty gray in color, and has a short, pointed, erect crest of white-tipped feathers. Closer inspection

reveals many darker, crescent-shaped marks on the neck and the forepart of the body, giving it a scaly appearance, whence its common name. There is also white streaking on the sides and buffy on the abdomen. All other native quail of the United States have either conspicuous dark or light markings on the upper parts or long, plumelike feathers projecting from the top of the head. Immature scaled quail have marks of rufous, black, and white on the upper parts, and their crests are brownish. After the first molt they resemble the adults.

The range of the scaled quail is restricted to the Upper and Lower Sonoran Zones throughout most of New Mexico, north to the Arkansas Valley of southeastern Colorado; east to southwestern Kansas, western Oklahoma, and western and southern Texas; south to southern Mexico; and west to southern Arizona. In this great region three geographic races have been recognized, two of which occur in the United States. One of these, the Arizona scaled quail (Callipepla squamata pallida), is found from Arizona and New Mexico to Colorado, Oklahoma, western Texas, northern Chihuahua, and Sonora. The other, the chestnut-bellied scaled quail (C. s. castanogastris), occurs from southern Texas to northern Tamaulipas, Nuevo Leon, and Coahuila. The range of the third and typical subspecific form, the scaled quail (C. s. squamata), is confined to central and southern Mexico.

Scaled quail are partial to dry, open country in valleys, plains, or foothills that have a mixture of bare ground, low herbaceous growth, and such brush cover as mesquite (Prosopis spp.), acacias (Acacia spp.), mimosas (Mimosa spp.), scrub oak (Quercus spp.), cacti (Opuntia spp., Echinocactus spp.), greasewood (Sarcobatus vermiculatus), broomweed (Gutierrezia spp.), chamisa or saltbush (Atriplex spp.), tomatilla (Lycium spp.), ocotillo (Fouquiera splendens), and desert hackberry (Celtis pallida), and, in the foothills, juniper (Juniperus spp.) and pinon pine (Pinus edulis). They also take to pastures and cultivated fields near suitable cover and sometimes become tame around farm and ranch houses.

Limited available field data indicate that a supply of drinking water is not necessary for the existence of scaled quail. They apparently can obtain all the water they need from their food and from dew. It seems probable that the species will not survive conditions far outside its native habitat. It apparently does not thrive in tall rank weeds, grass, and shrubbery as does the bobwhite, nor does it seem able to withstand cold weather. Transplantings to the Northern or the Eastern States, therefore, are likely to fail.

For a detailed life-history and game-management study of the scaled quail, which is urgently needed, one of the first requisites is a knowledge of the bird's food habits. Effort has here been made to bring together all the important available information on the bird's

food tendencies and to incorporate with it data thus far obtained by laboratory examination of a substantial series of stomachs.[1] One of the most noteworthy contributions to the literature on the food of the species is that of Judd (7, pp. 61-63), who reported on the contents of the stomachs and crops of 47 birds. This material has been reexamined by the writer and the results included among the data in this report. Other contributions, arranged chronologically, include Abert (1), Cassin (5, pp. 129, 130), Ridgway (in 3, vol. 3, pp. 488-491), Stockwell (9), Bendire (4, p. 20), Tate (12), Bailey (2, p. 217), and Ortenburger and Little (8, p. 190). These writers have discussed the bird's food mainly in general terms.

The present paper contains a summary of the analyses of the contents of the stomachs and crops of 258 adult and 9 immature scaled quail collected from numerous localities, as follows: Arizona: Santa Rita Range Reserve about 30 miles south of Tucson, Sulphur Springs Valley, Huachuca Mountains, Graham County, Oracle, McNeal, and Chiricahua Mountains; New Mexico: Fort Sumner, Carlsbad, Albuquerque, Fort Stanton, Roswell, Socorro, Hudson, Mesa Rodondo, Tucumcari, Logan, Montoya, Santa Rosa, San Andres Mountains, Corona, Tularosa, Floyd, and Queen; Texas: Ozona, Mertzon, Marfa, Juno, and Lipscomb; Mexico: Sonora; and New York: 3 birds released in Suffolk County.

FOOD OF ADULTS

The different items of food noted in the stomachs and crops examined totaled 657. Of these, 310 were vegetable, and 347 were animal matter. In table 1 only the 23 items that constituted 1 percent or more of the food are listed.

Vegetable Matter

As shown in the table, vegetable matter comprised 78.12 percent of the food. A great variety of items is represented, owing, no doubt, to the wide divergence in the character of the environments in which the stomach material was collected, as well as to the catholic tastes of the bird. In areas devoted to agriculture, grains were a conspicuous part of the food taken. Among these were oats (Avena sativa), 1.71 percent; kafircorn (Holcus sorghum), 5.44 percent; and wheat (Triticum spp.), 2.27 percent. In such areas scaled quail also ate seeds of weeds that commonly invade waste ground, such as amaranth (Amaranthus blitoides), 1.58 percent; alfilaria (Erodium cicutarium), 1.25 percent; croton (Croton texensis), 1.03 percent; buffalo burr (Solanum rostratum), 1.31

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[1] The writer acknowledges the assistance of associates in the Bureau in connection with stomach analyses and identifications of insect material; and of D. M. Gorsuch, of the Arizona Game and Fish Commission, and Paul Russell, of the New Mexico Game and Fish Commission, who collected much of the material used in the stomach analyses.

TABLE 1.--Monthly and yearly percentages of the principal items in the food of 258 adult scaled quail

(Food percentages based on total food content, gravel on total content; vegetable food, seeds unless otherwise noted; Tr indicates trace.)

Kind of food	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
Number of stomachs examined.....	9	5	8	7	3	6	7	15	26	30	107	35	----
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
VEGETABLE FOOD													
Oats (Avena sativa)....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8.38	1.88	10.27	1.71
Kafircorn (Holcus sorghum).	.....	.....	18.62	.....	.....	5.83	.....	9.26	14.80	10.62	4.01	2.20	5.44
Wheat (Triticum spp.)...	.....	.....	.....	.....	.....	.....	6.28	3.40	5.92	11.69	.....	.....	2.27
Sophia (Sophia menziesii) (pods and herbage).	.....	.....	27.49	26.60	17.66	.....	.....	.....	.....	.....	.....	.....	5.98
Amaranth (Amaranthus blitoides).	.....	.....	.....	.....	.....	.....	6.47	5.73	5.19	.20	1.02	.35	1.58
Lotus (Lotus trispermus)	.....	5.80	.....	1.90	25.39	.33	Tr	1.26	.....	.....	2.03	3.52	3.35
Vetch (Vicia exigus)....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15.45	.....	.....	1.29
Mesquite (Prosopis spp.)	4.00	1.00	.62	1.40	.33	1.00	1.42	.93	.34	.29	2.19	2.82	1.36
Alfilaria (Erodium cicutarium) (seeds and herbage).	.....	.....	.....	Tr	Tr	12.50	.....	.....	.....	.....	.....	2.52	1.25
Croton (Croton texensis)	1.44	Tr	3.87	.....	.....	.....	3.57	Tr	2.30	.48	.33	.30	1.03
Cactus (Opuntia spp.) (seeds and fruit).	.11	2.00	.....	.....	.....	.....	2.14	9.26	.11	.29	2.31	1.41	1.47
Evolvulus (Evolvulus arizonicus spp.)	.....	4.60	.37	.30	Tr	10.33	3.99	5.49	1.57	.03	1.25	.15	2.34
Morning glory (Ipomoea cardiophylla).	14.88	.....	.....	.....	.....	.....	.....	.06	.....	.81	4.14	1.17	1.76
Sage (Salvia spp.).....	.....	10.00	.....	.....	.....	.....	.....	.....	3.30	1.76	Tr	.....	1.26
Buffalo burr (Solanum rostratum).	.....	10.60	2.37	.....	.....	Tr	.....	.....	.....	Tr	.54	2.30	1.31
Broomweed (Gutierrezia texana).	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17.30	32.98	4.19
Sunflower (Helianthus annuus spp.).	20.91	Tr	.12	.....	.....	.....	.14	.....	.30	3.31	4.25	5.42	2.87
Miscellaneous green leaves, sprouts, and other herbage.	12.66	33.80	6.00	2.00	14.00	2.66	.28	1.00	10.35	5.57	9.52	16.42	9.52
Miscellaneous seeds with incidental pod and fruit debris and herbage.	42.34	22.80	21.04	36.30	8.62	18.85	42.29	36.41	21.48	34.22	44.42	8.89	28.14
Totals.....	96.34	90.60	80.50	68.50	66.00	51.50	66.58	72.80	65.66	93.10	95.19	90.72	78.12
ANIMAL FOOD													
Grasshoppers, locusts, and mantids (Orthoptera), 17 kinds.	Tr.	.....	.50	.10	17.33	5.48	9.68	19.29	15.94	2.91	1.76	.51	6.13
June beetles (Diplotaxis spp.).	.....	.....	.....	.....	.....	13.85	.....	.....	.....	.03	.....	.....	1.16
Weevils (Ophryastes spp.)	.....	.....	3.12	.....	.....	.....	.28	.73	9.46	.55	.46	2.33	1.41
Sawfly larvae (Tenthredinidae).	.....	.....	.....	14.25	.....	.16	.....	.....	.....	.....	.....	.....	1.20
Scale insects (Coccidae)	.....	.....	.....	9.00	5.00	.....	.....	.....	.....	1.18	.....	.....	1.26
Ants (Ischnomyrmex spp.)	.....	.....	7.37	.20	.....	7.33	Tr	.....	.....	.11	.20	.....	1.27
Miscellaneous insects and other animals.	3.66	9.40	8.51	7.95	11.67	21.68	23.46	7.18	8.94	2.12	2.39	6.44	9.45
Totals.....	3.66	9.40	19.50	31.50	34.00	48.50	33.42	27.20	34.34	6.90	4.81	9.28	21.88
Gravel.....	4.66	17.00	17.37	17.75	7.00	4.66	4.57	10.13	15.15	13.36	8.18	11.92	10.98

percent; and sunflowers (Helianthus annuus and other species), 2.87 percent. Stomachs that reflected these food preferences throughout most of the year were collected in the agricultural area in the vicinity of Tucumcari, N. Mex. The 3 stomachs of the birds introduced into New York State, and killed in October, contained such foods as the bobwhite would eat in an agricultural area, as wheat, kafircorn, oats, buckwheat (Fagopyrum fagopyrum), and ragweed (Ambrosia elatior).

In the stomachs collected in areas where only native vegetation was present such plants predominated as sophia (Sophia menziesii), 5.98 percent; lotus (Lotus trispermus), 3.35 percent; vetch (Vicia exigua), 1.29 percent; mesquite (Prosopis spp.), 1.36 percent; cactus (Opuntia spp.), 1.47 percent; evolvulus (Evolvulus arizonicus and other species), 2.34 percent; morning glory (Ipomoea cardiophylla), 1.76 percent; sage (Salvia spp.), 1.26 percent; and broomweed (Gutierrezia texana), 4.19 percent. This last item was predominant in winter stomachs from Ozona and Mertzon on the plains of western Texas, comprising 53.04 and 65.96 percent, respectively. Stomachs containing most of the above or closely related species came from such widely separated areas as the Santa Rita Range Reserve and the Huachuca Mountains, Ariz., the San Andres Mountains, N. Mex., the open country near Corona and Fort Sumner, N. Mex., and the pinon-juniper association near Queen, N. Mex.

The indiscriminate feeding habits of the scaled quail are indicated by the fact that no single plant item constituted as much as 6 percent of the yearly food of the species as a whole, while fully 292 were recorded merely as a part of one percent or as traces. Some of these, however, did constitute high percentages in a few stomachs from certain localities. Most of the vegetable items occurred as seeds, with, frequently, fragments of herbage and pods of the plant from which they came.

The more important seeds that have been segregated under the caption "Miscellaneous seeds with incidental pod, fruit debris, and herbage" were jointfir (Ephedra trifurca), foxtail (Chaetochloa macrostachya), panic grass (Panicum hallii), corn (Zea mays), sotol (Dasylirion spp.), snake-root (Aristolochia watsoni), mesquite (Prosopis velutina, P. juliflora, and P. glandulosa), acacia (Acacia vernicosa and other species), mimosa (Mimosa spp.), caltrop (Kallstroemia spp.), flax (Linum spp.), spurge (Chamaesyce spp.), queen's delight (Stillingia spp.), sida (Sida diffusa), ragweed (Ambrosia spp.), and figmarigold (Boebera papposa).

The principal fruits, usually indicated only by their seed residue, consisted of juniper (Juniperus sp.), desert hackberry (Celtis pallida), mistletoe (Phoradendron spp.), barrel cactus (Echinocactus wislizenii), other cacti (Opuntia spp.), and tomatilla (Lycium spp.). Their combined percentage, however, amounted to only 3.70 percent.

Animal Matter

Although animal matter formed 21.88 percent of the total food consumed, only Orthoptera, June beetles (Diplotaxis sp.), weevils (Ophryastes sp.), sawfly larvae (Tenthredinidae), scale insects (Coccidae), and ants (Ischnomyrmex sp.) amounted to more than 1 percent each of the total food, and of these only the first mentioned constituted more than 5 percent of the total.

The combined percentage of 322 miscellaneous animal items, no one of which totaled as much as 1 percent, amounted to less than 9 1/2 percent. These numerous items consisted of insects (Insecta), 292 kinds; millipeds (Diplopoda), 1; spiders (Arachnida; Araneida), 24; ticks (Acarina), 2; harvestmen (Phalangida), 2; and snails (Gastropoda), 1. The more important miscellaneous insects were plant bugs (Heteroptera: Thyanta spp., Aufeius spp., Nysius spp., and Lygaeus spp.); leafhoppers (Homoptera: Stictopelta spp., Agallia spp., Xerophloea spp., Jassinae, and Fulgoridae); aphids (Homoptera: Aphididae); termites (Isoptera: Nasutitermes spp.); beetles (Coleoptera), 115 kinds, including ground beetles (Carabidae, Selenophorus spp., and Collops spp.), ladybird beetles (Coccinellidae, Coccinella spp., and Hippodamia spp.), June beetles (Scarabaeidae, Diplotaxis spp.), leaf beetles (Chrysomelidae, Chaetocnema spp., and Diabrotica spp.); weevils (Curculionidae, Sphenophorus spp., and Thecesternus humeralis); flies (Diptera); wasps and bees (Hymenoptera); ants (Formicidae); and caterpillars (Lepidoptera: Nymphalidae and Noctuidae).

FOOD OF YOUNG

In accordance with a prevailing rule of the bird world, the stomachs of 9 young scaled quail examined contained a high percentage of animal matter (71.17), while vegetable matter comprised the complementary portion (28.83 percent). Gravel present constituted 6.26 percent of the gross stomach contents.

As in the adults, the vegetable food consisted chiefly of seeds. The only fruit remains were desert hackberry (Celtis pallida), 3.44 percent; cactus (Opuntia spp.), 1.06 percent; and nightshade (Solanum spp.), 0.6 percent. There was a trace of herbage.

The proportion of the species of seed taken seemed to depend upon what was available locally. The birds in the vicinity of cultivated ground had eaten weed seeds, such as pigweed (Amaranthus blitoides), 3.44 percent; sunflower (Helianthus annuus), 1.33 percent; and puccoon (Lithospermum sp.), 1.88 percent. Those from more remote plains or desert areas had eaten seeds of low-growing plants of those areas, such as lotus (Lotus trispermus), 4.73 percent; sida (Sida diffusa), 3.22 percent; and paspalum (Paspalum stramineum), 3.00 percent. In all, 21 kinds of seeds were taken, all of which also appeared in the food of the adults.

Important animal foods of the young quail included 3 kinds of grasshoppers and locusts (Melanoplus sp., Oedipodinae, and other Orthoptera), 20.07 percent; 30 kinds of beetles (Coleoptera), 16.71 percent; 19 kinds of bugs (Heteroptera), 8.69 percent; and 12 kinds of leafhoppers (Homoptera), 11.02 percent.

COMPARISON WITH FOOD OF OTHER QUAILS

On the basis of food reports by Handley (10, p.124), Gorsuch (6, pp. 31, 35), Judd (7, p. 49), and Sumner (11, pp. 175, 176) it is possible to compare the food of the scaled quail, as determined in this study, with that of the bobwhite, Gambel's quail, and the California quail. These comparisons are shown in table 2.

TABLE 2.--Summary of the food tendencies of four American species of quail

Species	Stomachs	Animal food	Vegetable food	Gravel	Authority 2/
	Number	Pct.	Pct.	Pct.	
Scaled quail....	258	21.88	78.12	10.98	Kelso
Bobwhite	1,659	14.41	85.59	3.46	Handley (10)
Gambel's quail 3/	178	8.99	91.58	20.00	Gorsuch (6)
California quail	601	2.15	97.85	---	Judd (7)
Do.....	102	.38	99.62	14.76	Sumner (11)

2/ Numbers underscored in parentheses refer to "Literature Cited," at the end.

3/ The remaining 1.43 percent consisted of "items occurring only as traces."

By comparison with Handley's report it was noted that the scaled quail had eaten less vegetable food, less fruit, more green herbage, and more grit than had the bobwhite. A comparison of data from 178 stomachs of Gambel's quail from southern Arizona and New Mexico with the data on the scaled quail reveals the fact that, in the same habitat, the two species have quite similar food habits, yet, on the basis of yearly food, Gambel's quail subsists on less than a third of the proportion of animal matter taken by the scaled quail. Both these species tend to take less herbage and grit and more animal matter in summer than in winter. Seeds, principally from legumes, are the staple food of both species.

The food of the California quail differs markedly from that of the scaled in the proportions of animal and vegetable matter present. Of the four species here discussed, the scaled quail is the least vegetarian, and the California the most. Furthermore, the California bird is a more pronounced fruit eater.

SUMMARY

The main tendencies in food habits of the scaled quail indicated in the data herein presented may be summarized as follows:

The food of 258 adults was composed principally of vegetable matter (78.12 percent), mostly seeds. In agricultural districts cultivated grains

and weed seeds predominated, while in less settled districts the seeds of legumes (Mimosaceae, Cassiaceae, and Fabaceae) predominated. Little fruit was taken. Considerable young green herbage was eaten (9.52 percent) in winter and early spring.

On the basis of the material examined, it appears that the scaled quail eats more animal matter than the bobwhite, Gambel's quail, or the California quail. Owing to its feeding on grasshoppers, plant bugs, scale insects, ground beetles, and weevils, the scaled quail may be of real service in agricultural areas as a natural check on these pests.

The food of 9 young scaled quail consisted mostly of animal matter (71.17 percent), chiefly grasshoppers, locusts, beetles, and plant bugs. Most of the vegetable food (28.83 percent) consisted of seeds.

It is hoped that those interested in the preservation and increase of scaled quail will find the information contained herein useful. The investigation has shown (1) the items that serve as food at different seasons; (2) that the bird eats a great variety of seeds of wild plants and insects; and (3) that it readily accepts seeds of certain crops or of plants incidentally introduced by man. From these facts areas may be judged as to their suitability for scaled quail, and ways devised to increase the food supply and cover. On the other hand, it should not be assumed that the chances of food shortage are slight because a great variety of seeds is acceptable. The birds have competitors in the many mammals that consume large quantities of seeds and seed-bearing plants; and grazing and drought may reduce the crop of foods as well as the cover. How these factors limit quail numbers in any particular locality must be determined by field observation.

LITERATURE CITED

(1) Abert, James William.
1847. [Minutes-reference to scaled quail]. Acad. Nat. Sci. Philadelphia Proc. 3: 221-222.

(2) Bailey, Florence Merriam.
1928. Birds of New Mexico. New York Department of Game and Fish. 807 pp., illus.

(3) Baird, Spencer Fullerton; Brewer, Thomas Mayo; and Ridgway, Robert.
1874. A history of North American birds. 3 vols., illus.

(4) Bendire, Charles.
1892. Life histories of North American birds. U. S. Natl. Mus. Special Bull. 1, 414 pp., illus.

(5) Cassin, John.
1856. Illustrations of the birds of California, Texas, Oregon, British and Russian America. 298 pp., illus.

(6) Gorsuch, David Major.
1934. Life history of the Gambel quail in Arizona. Univ. Arizona Bull. 5 (Biological Science Bull. 2), 89 pp., illus.

(7) Judd, Sylvester Dwight.
1905. The bobwhite and other quails of the United States in their economic relations. U. S. Dept. Agr. Biol. Survey Bull. 21, 66 pp., illus.

(8) Ortenburger, Arthur Irving, and Little, Elbert Luther, Jr.
1930. Notes on a collection of birds from western Oklahoma. Publ. Univ. Okla. Biol. Survey 2: 189-194.

(9) Stockwell, George Archie ("Archer").
1879. The game of America. 20th paper-The partridges. Chicago Field 12: 252-253.

(10) Stoddard, Herbert Lee.
1931. The bobwhite quail: Its habits, preservation, and increase. 559 pp., illus. (Food and feeding habits, by C. O. Handley.)

(11) Sumner, Eustace Lowell, Jr.
1935. A life history study of the California quail, with recommendations for its conservation and management. Part I. Calif. Fish and Game 21: 167-256, illus.

(12) Tate, Ralph Compton.
1925. Favorite foods of some Oklahoma birds. Univ. Okla. Bull. 322 (n. s.): 33-35. (Okla. Acad. Sci. Proc. Vol. 4, 1924. Univ. Studies No. 21.)